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The Locus of Cell Mechanisms

Terra Incognita between Cytology and Biochemistry

Until these ‘accidents’ occurred, workers engaged in the exploration of living organisms had been forced to stop at the edge of a mysterious no-man’s-land, bounded at the upper level of the dimension scale by the resolving power of the light microscope, and at the lower level by the applicability of chemical techniques. They knew, in a frustrating sort of way, that the area between these two boundaries contained some of the essential clues without which life would remain forever understandable. With the technical advances mentioned, this region suddenly became accessible, both to visual examination right down to the level of macromolecules, and to chemical separation and analysis right up to the level of microscopic entities.

(de Duve, 1963–4, pp. 49–50)

Having described in abstract terms what mechanisms are and how they figure in scientific explanation, I turn now to setting the stage historically for the contributions of cell biology. The project of identifying cell mechanisms began in earnest after 1940 in what was then unoccupied territory between cytology and biochemistry. Researchers were at best dimly aware that crucial cellular operations occurred in organelles for which no direct methods of investigation were available. These organelles were too small to be meaningfully examined with the light microscope and much larger than the reacting molecules in homogenates that biochemists prepared from broken cells. Investigating these organelles as mechanisms required structural tools more powerful than those of cytology, functional tools building on those already developed in biochemistry, and new techniques incorporating both types of tools in order to integrate structure and function.